INTEREST EPITOMIZED,

BOTH

COMPOUND and *SIMPLE.*

Very useful for every one that Lendeth or Borroweth; and for Purchasing and Selling of Annuities or Pensions, and Leases in Reversion.

WHEREUNTO IS ADDED,

A SHORT *APPENDIX*

For the Solution of *Adfected Equations* in Numbers by Approachment:

Performed by *LOGARITHMS.*

By *MICHAEL DARY*, Philomath.

LICENSED,

Nov. 27. 1676. Roger L'Estrange.

LONDON,

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TO THE HONOURED,
Sir *JONAS MOORE*, Knight,
SURVEYOR GENERAL;
EDWARD SHERBURNE, Esq; CLERK;
Of His MAJESTIES Ordnance and Armories.

SIRS,

I *May (by* some*) be accounted presumptuous, for sheltring this short little Tract of Interest under your protection: And truly but that I am well Experienced of your generous and condescending good Natures, I should be of the same mind too: But let me tell* them *it is something of Kin to you, for though I have taken the* pains, *yet out of your bounty you have been at the* cost, *otherwise it had not seen the light.*

I hope that my good meaning will not be misconstrued, for to me it seemed necessary that the business of Interest ought to be rectified; for in many Books the Equation of payments are built upon faulty Foundations: And though this be but a short little Tract, it may minister occasion for an abler Pen to write more Copious.

I know 'tis impossible to please all, though one should deliver very sound Mathematical *truths; for some will be offended at the manner of expressing them: But 'tis possible I may please some, and if I have but pleased you my worthy Patrons, I am satisfied; and shall continue my Prayers for your increase of happiness here, and* Interest *in that happiness which shall be everlasting.*

Sirs, your most humble and
much obliged Servant

 MICH. DARY.

Courteous Reader,

THou hast here presented to thy view and censure the business of Interest both Compound and Simple, laid down in Symbolical Theorems or Solutions fitted for that purpose; whether it be for one Single Sum paid either before or after it is due, or whether it be for many equal Sums paid either before or after they are due.

Some may Object and say, what need have we of these Symbolical Theorems, when we have so many Books of Interest Furnished already with Tables of various Rates of Interest both Compound and Simple. To which I Answer:

1. A Theorem represented by the disposition (or distribution) of Symbols bears a better Impression upon a *Mathematical Genius*, than a Theorem consisting of words.

2. In the business of Annuities and Pensions (that is, in many equal payments at many equal times) what *Herculean* labour is there if either the time of continuance, or the Rate of Interest shall be sought in Compound Interest? Whereas by the prescription of these Symbolical Theorems, and the use of Logarithms either of them may be found without any great difficulty.

3. Therefore that the Foundation of any sort of Tables concerning Interest either Compound or Simple may be well laid, I have (being hereunto requested) made this publick.

I think I need not explain the Characters and Signs used in these Symbolical Theorems or Solutions, because they be common and familiar to every Smatterer in the *Mathematicks*; yet that I may not be blamed for obscurity, I shall give this Explication.

1. $=$ Signifies equal to: and is the sign of Equation; as $a=b$, is *a* equal to *b*.

2. $>$ Signifies greater than: and is the sign of Majority; as $a>b$, is *a* greater than *b*.

3. $<$ Signifies lesser than: and is the sign of Minority; as $a<b$, is *a* lesser than *b*.

4. $+$ Signifies more: and is the sign of Addition; as $+a+b$, is

is more a more b. But sometimes the sign of the foremost quantity is omitted (yet understood) as $a+b=+a+b$.

5. — Signifies less: and is the sign of Subtraction; as $a-b$, is a less b.

6. × Signifies Multiplied by: and is the sign of Multiplication; as $a \times b$, is a Multplied by b. But oftentimes the sign of Connexion is omitted (yet understood) as $ab = a \times b$.

7. The sign of Division is a line drawn level between two or more quantities; as $\frac{b}{a}$, is b divided by a. Or sometimes thus $a)\,b\,($, a dividing b.

8. :: Denotes the middle of four proportionals; as $a.b::c.d$; to be read thus, as a to b, so c to d.

9. $\div\!\div$ Signifies continually.

10. (t) Signifies a Power Note; of such a Power as is intimated by t.

11. $\sqrt{}$ Signifies a Square Root: But according to Rule it ought to be exprest thus $\sqrt[2]{}$.

12. $\sqrt[t]{}$ Signifies a Root of such a Power as is intimated by t.

Moreover you must understand that in the use of Logarithms; Multiplication is performed by Addition; and Division by Subtraction; and Involution by Multiplication; and Evolution by Division: Also Continual Division (as when you find this Note $\div\!\div$) is performed by one Single Division.

Concerning the usual way of Rebate in Simple Interest which you may find in almost every Book of this nature; I say it doth not hold but only in the payment of single Sums, for when many equal payments are made at many equal times it faltereth and will not hold round. If any man say why you your self (in *page* 28) call it but a knack; 'tis true: Yet they shew themselves not very Skilful in the Intrigues of this knack; for let this Question be proposed:

There is an Annuity of 62 l. per annum *offered to be sold for* 4 *years, allowing the Purchaser* 6 l. per cent. per annum *Simple Interest. What is this Annuity worth in present Money?*

By their Tables it will be found to be worth 216.39 *l.*

Very

Very good, let it be granted that their Anſwer is true: then they muſt and ought to Anſwer theſe three reſulting Queſtions following.

Queſ. 1. *My Friend hath lately bought an Annuity for* 4 *years, and laying out his Money at* 6 l. per cent. per annum *Simple Intereſt, it coſt him* 216.39 l. *What is the Annual Rent?*

Queſ. 2. *My Friend hath lately bought an Annuity of* 62 l. per annum, *to continue* 4 *years, which coſt him* 216.39 l. *What Rate* per cent. per annum *Simple Intereſt had my Friend for his Money?*

Queſ. 3. *My Friend hath lately bought an Annuity of* 62 l. per annum, *and laying out his Money at* 6 l. per cent. per annum *Simple Intereſt, it coſt him* 216.39 l. *How long muſt my Friend enjoy the Premiſſes?*

Now if they ſhall reſolve theſe three Queſtions by their Tables, it will be a manifeſtation that their Tables are firm and good, as to this knack: Otherwiſe not.

WHereas I have laid down for Adfected Equations but two Methods of Approachment; yet if any man hath a deſire to make a third and a fourth, he may eaſily do it from the ſecond Method; for he need but alter the firſt Precept, and the other ſeven Precepts hold good without altering a word.

METHOD III.

1. Let the Supream Term of the propoſed Equation poſſeſs the left ſide of the Equation ſolely, Signed with the Sign $+$; and the reſt of the Terms in their Order you ſhall place on the right ſide, with their reſpective Signs: Then of each ſide you ſhall Extract ſuch a Root as is intimated by the *Index* (or Power Note) of the Supream Term; ſo is the Queſitious Root now ſolely on the left ſide: That done, you have an Equation which you may call *The Prepared Equation.*

Example.

Let the propoſed Equation be $+y(8) - 6y(3) = +200$

Then the *Prepared Equation* is $y = \sqrt[8]{:+6y(3)+200:}$

Method

METHOD IV.

1. LEt the Supream Term of the proposed Equation possess the left side of the Equation solely, Signed with the Sign +; and the rest of the Terms in their Order you shall place on the right side, with their respective Signs: Then you shall divide each side, by the Supream Term low'red one degree; so is the Quesitious Root now solely on the left side: That done, you have an Equation which you may call *The Prepared Equation.*

Example.

Let the proposed Equation be $+y(8) - 6y(3) = +200$

Then the prepared Equation is $y = + \frac{6}{y(4)} + \frac{200}{y(7)}$

There be some small faults crept in, which I desire thee favourably to amend before thou peruse the Book, and thou wilt oblige him that is

Thy well-meaning Friend,

MICH. DARY.

Page 1. *line* 10. for Proportionals, *read* Geometrical Proportionals.
Page 10. *line* 5. for Question, *read* Question is,
Page 10. *line* 6. for 74 l. *read* 740 l.
Page 10. *line* 19. for Interest, *read* Compound Interest.
Page 12. *and* 13. between r. and Q. write *Powers.*
Page 27. *line* 1. for 270 l. *read* 270.32 l.
Page 35. *line* 11. for of which right side, *read* then of each side.

TO THE

AUTHOR.

ARITHMETICK *will now be more esteem'd,*
Since 'tis by thee from all its faults redeem'd:
Here we may Practice now, with such delight,
As easie for to learn, as thee to Write;
Because from dregs of Error 'tis refin'd
By thy Pen, and thy Ingenious mind.
Then READER, *if thou hast an itch to be*
Dame-Fortunes Darling, for her Treasury,
The AUTHOR *for applause hath no design,*
But Modestly (his Interest) is thine:
Here's Argument and Reason so acute,
Which will oblige whom e're it doth confute.

S. L.

Compound Intereſt Epitomiz'd.

PART I.

SECTION I.

THe buſineſs of Compound Intereſt is indeed no more than to ſay Equation of Payments; for every Sum that is paid, is paid either before, or after, or when 'tis due; but if it be paid when 'tis due there is no need of this Artifice: So then that which muſt be ſpoken to, is concerning a Sum of Money paid either before or after it is due. This Artifice is founded upon the knowledge of a Rank of geometricall Proportionals continued, as may be ſeen evidently in the Works of our Learned Dr. *Wallis*; whoſe Symbols we ſhall make uſe of in the following *Theorems*.

If you put $a =$ a Principal or Sum forborn; $t =$ the Time of forbearance, in years, half years, quarters, or days; $r =$ the Rate of Intereſt *per cent.* by the year, half year, quarter, or by the day; $u =$ the Amount of the ſaid Principal, for the ſaid Time, at the ſaid Rate. Hence will ariſe theſe four Propoſitions.

Prop. 1. Queſ. u? Data a, r, t. Solu. $u = r(t) \times a$

Example. 216 l. *hath been forborn* 9 *years, what doth it amount to at* 6 l. per cent. per annum *Compound Intereſt?*

$r = 1.06$	its Logarithm $= 0,0253059$
$t =$	9
$r(t) =$ a Number	its Logarithm 0,2277531

$r(t)$

$r(t)=$ a Number	its Logarithm 0,2277531
$a=216$	its Logarithm 2,3344537
$u=364.927$	its Logarithm 2,5622068

So the Answer is 364 *l.* 18 *s.* 6 $\frac{1}{2}$ *d.*

Prop. 2. Quest. a? Data: u, r, t. Solu. $a=\frac{u}{r(t)}$

Example. 364 l. 18 s. 6 $\frac{1}{2}$ d. (*that is in Decimals* 364.927 l.) *is due* 9 *years hereafter; What is it worth in present Money, discompting at* 6 l. per cent. per annum *Compound Interest?*

$r=1.06$	its Logarithm 0,0253059
$t=$	9
$r(t)=$ a Number	its Logarithm 0,2277531
$u=364.927$	its Logarithm 2,5622068
$a=216$	its Logarithm 2,3344537

So the Answer is 216 *l.*

Prop. 3. Quest. t? Data: a, r, u. Solu. $t=r \div) \frac{u}{a}$

Example. 216 l. *hath been forborn a certain time, and at* 6 l. per cent. per annum *Compound Interest it doth amount to* 364 l. 18 s. 6 $\frac{1}{2}$ d. *What was the Time of forbearance?*

$u=364.927$	its Logarithm 2,5622068
$a=216$	its Logarithm 2,3344537
$r=1.06$	its Log. 0,0253059)0,2277531(9=t

So the Answer is 9 years.

Prop.

Prop. 4. Quef. r? Data: a, u, t. Solu. $r = \sqrt[t]{\frac{u}{a}}$

Example. 216 l. *hath been forborn* 9 *years, and at the end of the said term it did amount to* 364 l. 18 s. 6 ½ d. *at Compound Intereſt, the Queſtion is here, What was the Rate of Intereſt?*

$u = 364.927$	its Logarithm 2,5622068
$a = 216$	its Logarithm 2,3344537
$\frac{u}{a}$ = a Number	its Logarithm 0,2277531

$t = 9$) 0,2277531 (0,0253059 = Log. of 1.06
4.
2...
8.
—
00

So the Anſwer is 1.06.

SECTION II.

THe buſineſs of Compound Intereſt relating to many equal Payments, at many equal Times, is that Artifice by which Queſtions and Doubts are reſolved concerning Buying and Selling of Annuities and Penſions, and Leaſes in Reverſion, &c. And this Artifice may be conſidered under theſe four Particulars: 1. The Annuity or Penſion. 2. The Time of continuance or Number of equal Payments. 3. The Rate of Intereſt to be allowed the Purchaſer for his Purchaſe Money. 4. The Price or preſent worth (of all thoſe equal Payments at all thoſe equal Times) the Purchaſers Money being paid (or ſuppoſed to be paid) at one entire Payment, one of thoſe equal Times before his reception of the firſt Rent or Penſion.

Therefore if the Purchaſer ſhall pay his Purchaſe Money in

ſeveral parcels, at ſeveral times, before or after the ſaid mentioned time, all ſuch partial Payments are to be reduced and referred to one entire Payment, as if it were paid one of thoſe equal Times before his reception of the firſt Rent or Penſion; which may be done by that which hath been before taught, *viz.* what Payments are made before the ſaid Time are to be valued by Amount, and what Payments are made after the ſaid Time are to be valued by Diſcount; and ſuch Values by Amount or Diſcount, or both, ought to be eſteemed for that one entire Payment ſpoken of before.

This being premiſed, the buſineſs of Annuities and Penſions may be performed from a Rank of Geometrical Proportionals continually decreaſing: Wherein the Annuity is the firſt and greateſt Term; the Time of continuance is the Number of all the Terms ſave the firſt; the Rate of Intereſt is the common *Ratio* of this Rank; the Price or preſent worth is the Sum of all the Terms ſave the firſt. As in this Rank.

$$\frac{u}{1}+\frac{u}{r}+\frac{u}{r(2)}+\frac{u}{r(3)}+\frac{u}{r(4)}+\frac{u}{r(5)}+\frac{u}{r(6)}\text{ \&c.}$$

If you put $u =$, the Annuity or Penſion; $t =$ the Time of continuance; $r =$ the Rate of Intereſt; $p =$ the Price or preſent worth; then it will follow, that if any one of theſe four Particulars u, t, r, p, be ſought; it will be diſcovered by the other three, they being given. As in theſe four following Propoſitions.

Prop. 1. Queſ. p? Data: u, t, r. Solu. $p = \dfrac{u - \dfrac{u}{r(t)}}{r - 1}$

Example. There is a Leaſe of 40 l. per annum *(but to be paid quarterly by* 10 l. per *Quarter) being to be ſold for* 21 *years: What is it worth in preſent Money, allowing Comp. Int.* 6 l. per cent. per annum *to the Purchaſer?*

Here the Rate of Intereſt is 6 *l. per cent. per annum*, that is 1.06,

1.06, its Logarithm is 0,0253059; and because the Payments are made quarterly, you must take $\frac{1}{4}$ of the said Logarithm, and that will be 0,0063265; its Absolute Number = 1.014674 = *r*. The work follows.

$r = 1.014674$	its Logarithm 0,0063265
$t =$	84
	0,0253060
	0,506120
$r\,(t) =$ a Number	its Logarithm 0,5314260
$u = 10$	its Logarithm 1,0000000
$\frac{u}{r\,(t)} = 2.94153$	its Logarithm 0,4685740
$u - \frac{u}{r\,(t)} = 7.05847$	its Logarithm 0,8487107
$r - 1 = 0.014674$	its Logarithm $\bar{2}$,1665485
$p = 481.017$	its Logarithm 2,6821622

So the Answer is, the 40 *l.* Annuity will (upon the conditions before recited) be worth 481 *l.* 0 *s.* 4$\frac{1}{4}$ *d.* This agrees with Mr. *Mayne*, in his *Socius Mercatoris*, pag. 134.

Prop. 2. Quef. *u*? Data: *p*, *t*, *r*. Solu. $u = \frac{r\,(t) \times : \overline{r - 1} : \times p}{r\,(t) - 1}$

Example. There is 300 l. *lies ready in bank, to be laid out at Comp. Int.* 6 l. per cent. per annum, *to buy an Annuity for* 10 *years, the first Rent to be received at the end of* 5 *years after the Purchasers Money is paid: The Question is, What Annuity this* 300 l. *(upon the conditions aforesaid) will purchase?*

First, because the Interval of Time is here 5 years, you must find the Amount of the 300 *l* at the end of 4 years by *Prop.* 1. *Sect.* 1. and you will find it to be 378.742 *l.*

r =

$r = 1.06$	its Logarithm 0,0253059
$t =$	10
$r(t) = 1.79084$	its Logarithm 0,2530590
$r - 1 = 0.06$	its Logarithm $\bar{2}$,7781512
$p = 378.742$	its Logarithm 2,5783448
$r(t) \times : \overline{r - 1} : \times p =$ a Number	its Logarithm 1,6095550
$r(t) - 1 = 0.79084$	its Logarithm $\bar{1}$,8980886
$u = 51.459$	its Logarithm 1,7114664

So the Anſwer is, That the 300 *l.* lying ready in bank will (upon the conditions before recited) buy an Annuity of 51 *l.* 9 *s.* 2 $\frac{1}{4}$ *d. per annum.* This agrees with Dr. *Newton*, in his *Scale of Intereſt*, *pag.* 99. *prop.* 4.

Prop. 3. Queſ. t? Data: p, r, u. Solu. $t = \frac{r(t)}{r \div\div} = \frac{u}{p + u - pr}$

Example. A *borrows of* B 800 l. *for which* A *makes over a Houſe of* 25 l. *Rent* per *Quarter (without fraud or deceipt) which Rent* B *is now intitled to receive and injoy*, *ſo long time 'till he hath full ſatisfaction for his* 800 l. *lent to* A; *and they both agree at the Rate of Compound Intereſt* 6 l. per cent. per annum. *Now the Queſtion is*, *How long muſt* B *injoy the Premiſſes for his* 800 l?

$u = 25$	its Logarithm 1,3979400
$r = 1.014674$	its Logarithm 0,0063265
$p = 800$	its Logarithm 2,9030900
$pr = 811.7392$	its Logarithm 2,9094165
$p + u - pr = 13.2608$	its Logarithm 1,1225745
$r(t) =$ a Number	its Logarithm 0,2753655
	0,0063265

$$\begin{array}{r} 0,0063265\ )\ 0,2753655\ (\ 43.5257 = t \\ 22305. \\ 33260. \\ 16275. \\ 36220. \\ 45875. \\ \hline 15895 \end{array}$$

So the Anſwer is, That *B* will be fully ſatisfied for his 800 *l.* (upon the conditions before recited) in 43 Quarters and 47 Days.

If it be further inquired to know what is the laſt and leaſt Payment of Rent that *B* muſt receive, I anſwer, it is 13 *l.* 2 *s.* 10 *d.* This agrees with Mr. *Mayne, pag.* 138.

Prop. 4. Queſ. r? Data: u, t, p. Solu. $r = \frac{p+u}{p} - \frac{u}{r^{(t)} \times p}$

This fourth Propoſition is ſomething troubleſome to reſolve, in regard that r (the unknown Symbol) cannot be brought to one ſide of the Equation ſolely, and the other ſide clear: 'Tis confeſt that this Propoſition will admit of divers forms of Equations; but I can aſſure you of all that I have tried, this is the ſwifteſt in the approach performed by Logarithms. *Alſo* it is to be noted, That this Propoſition (let it ſtand in what faſhion or form you will) in any Equation, hath two Roots in it, whereof one is $r = 1$, and this Root will reſolve the Equation, but not the Propoſition; there is alſo another Root in this Equation, *viz.* $r > 1$, but $r < 1 + \frac{u}{p}$, and this is the Root that will reſolve the Propoſition: Wherefore you may for your firſt Suppoſition put $r = 1 + \frac{u}{2p}$, the Arithmetical Mean between 1 and $1 + \frac{u}{p}$, and you will by an Approach in Logarithms ſuddenly come to a period.

Example.

Example. An Annuity of 100 l. per annum *for 7 years, is offered to be sold for* 500 l. *present Money: What Rate of Compound Interest hath the Purchaser for his Money?*

If this Example be applied to the Symbolical Theorem for Solution, it will stand thus in Numbers:

$$r = + 1.2 - \frac{0.2}{r(7)}$$

Then according to that before said, I put for my first Supposition $r = 1.1$

$r = 1.1$	its Logarithm 0,0413927
	7
$r(7) =$ a Number	its Logarithm 0,2897489
0.2	its Logarithm $\bar{1}$,3010300
$\frac{0.2}{r(7)} = 0.102634$	its Logarithm $\bar{1}$,0112811
$r = 1.09211$	its Logarithm 0,0382634
	7
$r(7) =$ a Number	its Logarithm 0,2678438
0.2	its Logarithm $\bar{1}$,3010300
$\frac{0.2}{r(7)} = 0.107941$	its Logarithm $\bar{1}$,0331862
$r = 1.09195$	its Logarithm 0,0382022
	7
$r(7) =$ a Number	its Logarithm 0,2674154
0.2	its Logarithm $\bar{1}$,3010300
$\frac{0.2}{r(7)} = 0.108049$	its Logarithm $\bar{1}$,0336146

$r = 1.09195$, the last R

Now

Now I see I am come to a Period, because the last result is equal to the precedent suppositious Root. So the Answer to this Question is, That the 500 *l.* being laid out upon the Conditions before recited, the Purchaser is allowed Compound Interest, after the Rate of 9 *l.* 03 *s.* 10 *d.* $\frac{1}{4}$. *per cent. per annum.* This agrees with Dr. *Newton*, in his Scale of Interest. *Page* 103.

This Example I have wrought by the Second Method of Approachment, but if any one hath a desire to work it out by the First Method, the Symbolical Theorem ought then to stand thus.

$$r(t) \times : \overline{\frac{p+u}{p}} - r := \frac{u}{p}$$

SECTION III.

THe business of Compound Interest infinite (so called, because the number of Terms here are infinite) is that Artifice, whereby Questions and Doubts are resolved, concerning Buying and Selling of Estates (in Fee Simple) for ever; And herein we may consider these three Particulars: 1, The Annuity or Pension; 2, The Rate of Interest to be allowed for the Purchase Money; 3, The Price or present worth (of all those infinite Numbers of equal Payments at all those infinite Number of equal Times) the Purchasers Money being paid (or supposed to be paid) at one entire Payment, one of those equal Times before his reception of the first Rent or Pension.

This being Premised, be businesses of Compound Interest, infinite may be performed from the *Hyperbolical Spaces*, or from a Rank of Geometrical Proportionals continually decreasing infinitely: Wherein the Annuity or Pension is the first and greatest Term; the Price or present worth is the Sum of all the Terms save the first; the Rate of Interest allowed the Purchaser is the common *Ratio* of this Rank of Geometrical Proportionals: As you may see in that Rank laid down before.

If you put u = the Annuity or Pension; r = the Rate allowed for Interest; p = the Price or present worth: Then it will follow, that if any one of these three Particulars u, r, p, be sought, it will be discovered by the other two, they being given. As in these three Propositions.

Prop. 1. Quef. u? Data: p, r. Solu: $u = p \times \overline{r - 1}$:

Example. A Gentleman hath 740 l. *by him, and he would therewith Purchase a Free-hold Estate for a Nephew of his; And he would lay out his Money at* 6 l. per cent. per annum, *Compound Interest: The Question is, what this Free-hold Estate will be worth Annually that shall be bought for* 740 l?

$$\begin{array}{r} 740 = p \\ 0.06 = r - 1 \\ \hline 44.40 = u \end{array}$$

I Answer, it is worth 44 *l.* 08 *s.* 00 *d. per annum.*

Prop. 2. Quef. p? Data: u, r. Solu: $p = \dfrac{u}{r - 1}$

Example. There is a Free-hold Annuity of 44 l. 08 s. 00 d. per annum *to be sold for ever, and the seller will willingly allow the Purchaser Compound Interest,* 6 l. per cent. per annum: *The Question is, what sum of Money will Purchase this Estate?*

$$\begin{array}{r} u \\ r - 1 = 0.06)\,44.40\,(740\ l. = p \\ 2\ .\ . \\ \hline 000 \end{array}$$

I Answer, it is worth 740 *l.*

Prop. 3. Quef. r? Data: p, u. Solu: $r = \dfrac{p + u}{p}$

Example. My Friend hath lately bought a Free-hold Estate for ever, and it is really worth 44 l. 08 s. 00 d. per annum, *for which he gave* 740 l. *Now I would gladly know what Rate of* Compound *Interest my Friend had for his Money?*

$$\begin{array}{r} 740 = p \\ 44.4 = u \\ \hline p = 740)\,784.4\,(1.06 = r \\ 44\,.\,. \\ \hline 0000 \end{array}$$

I Answer, 6 *l per cent. per annum.*

Further-

FUrthermore, if it be inquired how many years Purchase any Annuity is worth; you must have respect unto the Interval of Time between the Purchasers Payment, and his reception of the first Rent: And (as before is taught) you must reduce and referr his Payment or Payments to one intire Payment, as if it were paid one year before his Reception of the first Rent.

This being premised, If you put $y =$ the Number of years; and $r =$ the Rate allowed for Interest; it holds: If either of these two particulars y, r, be sought, it is discovered by the other, that being given. As in these two following Propositions.

Prop. 1. Ques. y? Data: r. Solu: $y = \frac{1}{r-1}$

Example. There is a Free-hold Estate to be sold for ever; How many years Purchase is it worth, allowing the Purchaser Compound Interest, 6 l. per cent. per annum?

$$r - 1 = 0.06)\ 1.00000\ (16.666 = y$$
$$44444$$

The Answer is $16\frac{2}{3}$ years.

Prop. 2. Ques. r? Data: y. Solu: $r = \frac{y+1}{y}$

Example. A Gentleman would buy a Free-hold Estate for ever; and he will give but 14 years Purchase for it: The Question is, what Rate of Compound Interest he values his Money at?

$$14 = y$$
$$1$$

$$y = 14)\ 15.00000\ (1.07143 = r$$
$$1..$$
$$2.$$
$$6.$$
$$4.$$
$$-2$$

The Answer is 7 *l.* 02 *s.* 10 *d.* $\frac{1}{4}$

SECTION IV.

IF any one ſhall think it better to uſe natural Numbers than Logarithms, in thoſe eight Propoſitions of *Section* 1, and *Section* 2; he muſt know that the Power Note $r(t)$ cannot well be had without the aid of Logarithms; and indeed that being once had, then thoſe eight Propoſitions may be performed by natural Numbers: And if he pleaſeth he may make to himſelf three Tables of *Ratio's*, one for whole years, one for quarters, and one for days; by this Theorem, $u = r(t) \times a$: putting $a = 1$ *l.* $r =$ the Rate of Intereſt intended, $t =$ the time gradually increaſing; Then will u be the ſeveral Powers of the *Ratio* $= r(t)$

A Table of the ſeveral Powers of the Ratio *of* 6 l. per cent. per annum, *Compound Intereſt for* 31 *Years*, *or* 124 *Quarters.*

Y.	powers	Q.	Y.	powers	Q.	Y.	powers	Q.
	1.000000		4	1.262477	16	8	1.593848	32
	1.014674			1.281002			1.617236	
	1.029563			1.299799			1.640967	
	1.044670			1.318872			1.665046	
1	1.060000	4	5	1.338225	20	9	1.689479	36
	1.075554			1.357862			1.714270	
	1.091336			1.377787			1.739425	
	1.107351			1.398005			1.764949	
2	1.123600	8	6	1.418519	24	10	1.790847	40
	1.140087			1.439334			1.817126	
	1.156817			1.460455			1.843790	
	1.173792			1.481885			1.870846	
3	1.191016	12	7	1.503630	28	11	1.898298	44
	1.208493			1.525694			1.926154	
	1.226226			1.548082			1.954418	
	1.244219			1.570798			1.983096	

A Table of the several Powers of the Ratio of 6 l. per cent. per annum, *Compound Interest for 31 Years, or* 124 *Quarters.*

Y.	powers	Q.	Y.	powers	Q.	Y.	powers	Q.
12	2.012196	48	19	3.025599	76	26	4.549383	104
	2.041723			3.069996			4.616139	
	2.071683			3.115045			4.683876	
	2.102082			3.160755			4.752607	
13	2.132928	52	20	3.207135	80	27	4.822346	108
	2.164226			3.254196			4.893108	
	2.195984			3.301948			4.964909	
	2.228207			3.350400			5.037763	
14	2.260904	56	21	3.399564	84	28	5.111686	112
	2.294080			3.449448			5.186695	
	2.327743			3.500065			5.262803	
	2.361900			3.551424			5.340029	
15	2.396558	60	22	3.603537	88	29	5.418388	116
	2.431725			3.656415			5.491896	
	2.467407			3.710069			5.578571	
	2.503614			3.764509			5.660431	
16	2.540351	64	23	3.819749	92	30	5.743491	120
	2.577628			3.875800			5.827770	
	2.615452			3.932673			5.913284	
	2.653831			3.990380			6.000054	
17	2.692773	68	24	4.048934	96	31	6.088101	124
	2.732286			4.108348				
	2.772379			4.168633				
	2.813061			4.229803				
18	2.854339	72	25	4.291870	100			
	2.896223			4.354849				
	2.938722			4.418751				
	2.981844			4.483591				

A Table

A Table shewing the Number of Days, from the

January 31	*February* 28	*March* 31	*April* 30	*May* 31	*June* 30
February 59	*March* 59	*April* 61	*May* 61	*June* 61	*July* 61
March 90	*April* 89	*May* 92	*June* 91	*July* 92	*August* 92
April 120	*May* 120	*June* 122	*July* 122	*August* 123	*September* 122
May 151	*June* 150	*July* 153	*August* 153	*September* 153	*October* 153
June 181	*July* 181	*August* 184	*September* 183	*October* 184	*November* 183
July 212	*August* 212	*September* 214	*October* 214	*November* 214	*December* 214
August 243	*September* 242	*October* 245	*November* 244	*December* 245	*January* 245
September 273	*October* 273	*November* 275	*December* 275	*January* 276	*February* 273
October 304	*November* 303	*December* 306	*January* 306	*February* 304	*March* 304
November 334	*December* 334	*January* 337	*February* 334	*March* 335	*April* 334
December 365	*January* 365	*February* 365	*March* 365	*April* 365	*May* 365

beginning of any Month, to the end of any other.

July 31	August 31	September 30	October 31	November 30	December 31
August 62	September 61	October 61	November 61	December 61	January 62
September 92	October 92	November 91	December 92	January 92	February 90
October 123	November 122	December 122	January 123	February 120	March 121
November 153	December 153	Janaary 153	February 151	March 151	April 151
December 184	January 184	February 181	March 182	April 181	May 182
January 215	February 212	March 212	April 212	May 212	June 212
February 243	March 243	April 242	May 243	June 242	July 243
March 274	April 273	May 273	June 273	July 273	August 274
April 304	May 304	June 303	July 304	August 304	September 304
May 335	June 334	July 334	August 335	September 334	October 335
June 365	July 365	August 365	September 365	October 365	November 365

A Table

A Table of the several Powers of the Ratio *of* 6 l. per cent. per annum, *Compound Interest for Days.*

days.	Powers.	days.	Powers.	days.	Powers.
0	1.000000	30	1.004801	60	1.009624
1	0160	31	4961	61	9786
2	0319	32	5121	62	9947
3	0479	33	5282	63	1.010108
4	0639	34	5442	64	0269
5	0798	35	5603	65	0431
6	0958	36	5764	66	0592
7	1118	37	5924	67	0753
8	1278	38	6085	68	0915
9	1438	39	6245	69	1076
10	1598	40	6406	70	1237
11	1757	41	6567	77	1398
12	1917	42	6727	72	1560
13	2077	43	6888	73	1722
14	2237	44	7049	74	1883
15	2397	45	7209	75	2045
16	2557	46	7370	76	2207
17	2717	47	7531	77	2368
18	2878	48	7692	78	2530
19	3038	49	7853	79	2691
20	3198	50	8014	80	2853
21	3358	51	8175	81	3015
22	3518	52	8336	82	3177
23	3678	53	8497	83	3338
24	3839	54	8658	84	3500
25	3998	55	8818	85	3662
26	4159	56	8980	86	3824
27	4320	57	9141	87	3986
28	4480	58	9302	88	4147
29	4640	59	9463	89	4309

A Table of the several Powers of the Ratio *of* 6 l. per cent. per annum, *Compound Interest for Days.*

days.	Powers.	days.	Powers.	days.	Powers.
90	1.014471	120	1.019346	150	1.024235
91	4633	121	9504	151	4399
92	4795	122	9667	152	4562
93	4957	123	9830	153	4726
94	5119	124	9992	154	4989
95	5281	125	1.020155	155	5053
96	5443	126	0318	156	5217
97	5605	127	0481	157	5380
98	5768	128	0644	158	5544
99	5930	129	0807	159	5708
100	6093	130	0970	160	5871
101	6254	131	1133	167	6035
102	6417	132	1296	162	6199
103	6579	133	1461	163	6363
104	6741	134	1622	164	6527
105	6903	135	1785	165	6691
106	7066	136	1948	166	6855
107	7228	137	2112	167	7018
108	7397	138	2275	168	7182
109	7553	139	2438	169	7346
110	7715	140	2601	170	7510
111	7878	141	2765	171	7675
112	8046	142	2928	172	7839
113	8203	143	3091	173	8003
114	8365	144	3254	174	8167
115	8528	145	3418	175	8331
116	8691	146	3581	176	8495
117	8853	147	3745	177	8659
118	9016	148	3908	178	8824
119	9179	149	4072	179	8988

A Table of the several Powers of the Ratio *of* 61. per cent. per annum, *Compound Interest for Days.*

days.	Powers.	days.	Powers.	days.	Powers.
180	1.029152	210	1.034093	240	1.039057
181	9316	211	4258	241	9223
182	9481	212	4423	242	9389
183	9645	213	4588	243	9555
184	9809	214	4753	244	9721
185	9974	215	4919	245	9887
186	1.030138	216	5084	246	1.040053
187	0303	217	5249	247	0219
188	0467	218	5414	248	0385
189	0632	219	5580	249	0551
190	0796	220	5745	250	0717
191	0961	221	5910	251	0883
192	1126	222	6076	252	1050
193	1290	223	6241	253	1216
194	1455	224	6407	254	1382
195	1619	225	6572	255	1548
196	1784	226	6737	256	1715
197	1949	227	6903	257	1881
198	2137	228	7069	258	2047
199	2278	229	7234	259	2214
200	2443	230	7400	260	2380
201	2608	231	7565	261	2546
202	2773	232	7731	262	2713
203	2938	233	7897	263	2879
204	3103	234	8062	264	3046
205	3268	235	8228	265	3212
206	3413	236	8394	266	3379
207	3598	237	8560	267	3545
208	3758	238	8725	268	3712
209	3928	239	8891	269	3879

A Table of the several Powers of the Ratio *of* 6 l. per cent. per annum, *Compound Interest for Days.*

days.	Powers.	days.	Powers.	days.	Powers.
270	1.044045	302	1.049393	334	1.054767
271	4212	303	9560	335	4935
272	4379	304	9728	336	5104
273	4545	305	9895	337	5272
274	4712	306	1.050063	338	5441
275	4879	307	0230	339	5609
276	5046	308	0398	340	5779
277	5213	309	0566	341	5946
278	5380	310	0734	342	6115
279	5546	311	0901	343	6284
280	5713	312	1021	344	6452
281	5884	313	1237	345	6621
282	6057	314	1405	346	6790
283	6214	315	1573	347	6958
284	6381	316	1738	348	7127
285	6548	317	1908	349	7296
286	6711	318	2076	350	7465
287	6883	319	2244	351	7633
288	7050	320	2412	352	7802
289	7217	321	2580	353	7971
290	7384	322	2748	354	8140
291	7551	323	2916	355	8309
292	7719	324	3084	356	8478
293	7886	325	3253	357	8647
294	8053	326	3421	358	8816
295	8220	327	3589	359	8985
296	8388	328	3757	360	9154
297	8555	329	3925	361	9323
298	8723	330	4094	362	9492
299	8890	331	4262	363	9662
300	9057	332	4430	364	9838
301	9225	333	4599	365	1.060000

BEfore you can well make use of the two foregoing Tables of the several *Powers of Ratio's*, it will be requisite that you understand these two Particulars: 1, The property of a *Decimal Fraction*; 2, Contractive *Multiplication*.

1. A *Decimal Fraction* is a Fraction whose Denominator is 10, or some potestate of 10; as $\frac{7}{10}$, $\frac{7}{100}$, $\frac{7}{1000}$, *&c.* but it may be more commodiously exprest without its Denominator thus, 0.7, 0.07, 0.007; And forasmuch as one Farthing in our *English* Coin is $\frac{1}{960}$ of a pound Sterling, therefore 0.001 is something less then a Farthing: And because 2 *s.* is the $\frac{1}{10}$ of 1 *l.* it may be exprest in Decimals thus 0.1, and for the same Reason 1 *s.* is exprest thus 0.05, and 6 *d.* thus 0.025, and 3 *d.* thus 0.0125: But I told you before that 1 in the third place from Unity was less than a Farthing, therefore you need not trouble your self with any Figure standing in the fourth place; but it shall suffice, if you value a *Decimal Fraction* in Coin but to the third place, provided that you get all the whole Six pences, *viz.* that the Remainer after valuation may be less than 25; and such a Remainer you may discreetly value for Farthings.

2. You must note that Contractive *Multiplication* is performed thus: You must Revert the *Multiplicator*, and then Multiply every Figure of the *Multiplicator* into so many Figures of the *Multiplicand* as stand equal with it towards the left hand, only you must have some respect unto what would have been brought, if the next Figure toward the right hand had been Multiplied, setting every partial Product Ranging equal with your *Multiplicand* toward the right hand.

Example 1. *A sum of Money, to wit*; 71 l. 05 s. 02 d. *hath been forborn* 5 *years: What doth it amount to, at Compound Interest* 6 l. per cent, per annum?

I find in the Table of years just against 5 years, 1.338225; and

and 71 *l.* 05 *s.* 02 *d.* in Decimals is 71.258, which Reverted, is 852.17.

```
1.338225
  852.17
--------
9367575
 133822
  26764
   6691
   1070
--------
95.35922
```

So the Anſwer is 95 *l.* 07 *s.* 02 *d.* $\frac{1}{4}$.

Example 2. *A ſum of Money, to wit,* 95 l. 07 s. 02 d. $\frac{1}{4}$, *is aue at the end of* 5 *years: What is it worth in preſent Money, diſcounting after* 6 l. per cent. per annum *Comp. Int.?*

I find in the Table of years juſt againſt 5 years, 1.338225, and by it I divide the ſum propoſed being Decimalized.

```
1.338225 ) 95.359000000 ( 71.257 11/13
           9367575....
           -------
            1683250
            1338225
           -------
            3450250
            2676450
           -------
             7738000
             6691125
            --------
             10468750
              9367575
            --------
              1101175
```

So the Anſwer is 71 *l.* 05 *s.* 02 *d.* *ferè.*

Example

Example 3. *There is a Lease of* 40 l. per annum, (*but to be paid quarterly by* 10 l. per *quarter*) *being to be sold for* 21 *years: What is it worth in present Money, allowing the Purchaser* 6 l. per cent. per annum, *Compound Interest?*

1. Because this Rent is to be paid quarterly, I must have recourse to the quarterly Table, and I find just against 84 quarters this Number 3.399564, by which I divide the quarterly Rent, *viz.* 10 *l.*

```
3.399564) 10.000000000000 (2.941553
          6799128......
          -------------
          32008720
          30596076
          --------
           14126440
           13598256
           --------
             5281840
             3399564
             -------
             18822760
             16997820
             --------
              18249400
              16997820
              --------
               12515800
               10198692
               --------
                2317108
```

2. From

		l.
2.	From the quarterly Rent ———	10
	I Subtract this Quotient ———	2.941553
	Rests ———————	7.058447 (481.017
		58696..
3.	This Rem. I divide by the *Ratio* less 1 -- = 0.014674)	118884
		117392
		14927
		14674
		25300
	So the Answer is 481 *l.* 00 *s.* 04 *d.* $\frac{1}{4}$.	14674
		106260
		102718
		3542

Example 4. *There is* 200 l. *lies ready in Bank, to be laid out at* 6 l. per cent. per annum, *to buy an Annuity for* 12 *years; the first Rent to be Received at the end of one year, after the Purchasers Money is paid: The Question is, what Annuity this* 200 l. *(upon the conditions aforesaid) will Purchase?*

1. First I look in the Table of years for one Term more then the time proposed, *viz.* thirteen years, and I find this number 2.132928.

2. Again, I look for the just time, twelve years, and find 2.012196.

3. I Subtract, and there Rests 0.120732.

4. I Multiply the Remainer by the sum proposed, 200.

5. I

5. I divide by the lesser Number made less an Unite; 1.012196.

```
             2.132928
             2.012196
             --------
             0.120732
                  200
             --------
 1.012196 ) 24.146400 ( 23.855
            2024392.
            --------
             3902480
             3036588
             --------
              8658920
              8027568
              -------
               5613520
               5060980
               -------
                5525400
                5080980
                -------
                 464420
```

So the Answer is, that the 200 *l.* lying in Bank, will (upon the Conditions beforesaid) Purchase an Annuity of 23 *l.* 17 *s.* 01 *d.* $\frac{1}{4}$ *per annum.*

Simple

Simple Intereſt Epitomiz'd.

PART II.

SECTION I.

WHen I was writing of *Compound Intereſt*, I did not at all intend any thing of *Simple Intereſt*; but being deſired by ſome to ſpeak briefly to it, I ſhall fulfill their deſire.

The buſineſs (then) of *Simple Intereſt* is founded upon this

LEMMA.

If a pair of Ranks of Numbers ſhall be poſited, having the ſame common Ratio *between every pair of Correſpondents; then, as well as the Numbers themſelves, their Correſpondent ſums, and their Correſpondent differences, have the ſame common* Ratio.

37 — 111			1.00 — 7.00	
21 — 063			1.06 — 7.42	
05 — 015		*Illuſtration*	1.12 — 7.84	
41 — 123			1.18 — 8.26	
13 — 039			1.24 — 8.68	

In the firſt pair of Ranks the *Ratio* is 3; therefore you may take any Number in the firſt Rank of that pair, if you pleaſe 13: and it holds, as 13 to 39 :: So is the ſum of the firſt Rank 117 to the ſum of the ſecond Rank 351. And *Contra*.

In the ſecond pair of Ranks the *Ratio* is 7; therefore you may take any Number in the firſt Rank of that pair, if you pleaſe 1: and it holds, as 1 to 7 :: So is the ſum of the firſt Rank 5.6 to the ſum of the ſecond Rank 39.2. And *Contra*.

In reſolving of Queſtions of *Simple Intereſt*, concerning a ſingle ſum paid, either before or after 'tis due, we may conſider theſe four Particulars: 1, The principal or ſum forborn; 2, The time of the forbearance; 3, The gain (by ſome called the *Ratio*) of 1 *l.* in one year; 4, The amount of the ſaid Principal, for the ſaid time, at the ſaid gain or Rate.

If you put $a =$ the principal or ſum forborn; $t =$ the time of forbearance in years or parts of a year; $g =$ the Gain (or Rate) of 1 *l.* in one year; $u =$ the amount of the ſaid principal, for the ſaid time, at the ſaid Gain or Rate: It will follow, that if any one of theſe four Particulars a, t, g, u, be ſought; it will be diſcovered by the other three, they being given. As in theſe four Propoſitions following.

Prop. 1. Queſ. u? Data: a, g, t. Solu: $u = :\overline{gt + 1}: \times a$

Example. 218 l. *hath been forborn 4 years; what doth it amount to at* 6 l. per cent. per annum *Simple Intereſt?*

$$a = 218. \quad g = 0.06. \quad t = 4.$$

$$\begin{array}{lr} gt + 1 = & 1.24 \\ a = & 218 \\ \hline & 992 \\ & 124 \\ & 248 \\ \hline \end{array}$$

270.32 = 270 l. 06 s. 05 d. *ferè* $= u$. The Anſwer.

Prop. 2. Queſ. a? Data: u, g, t. Solu: $a = \dfrac{u}{gt + 1}$

Example.

Example. 270.32 l. (*or* 270 l. 06 s. 05 d.) *is due* 4 *years hereafter; what is it worth in present money, discounting at* 6 l. per cent. per annum *Simple Interest?*

$$u = 270.32. \quad g = 0.06. \quad t = 4.$$

$$\begin{array}{llll} gt+1 & u & a & \\ 1.24\,) & 270.32\,(& 218\,l. & \text{The Answer.} \\ & 22. & & \\ & \underline{99.} & & \\ & 000 & & \end{array}$$

Prop. 3. Quest. t? Data: a, u, g. Solu: $t = \frac{u - a}{ag}$

Example. 218 l. *hath been forborn a certain time, and at* 6 l. per cent. per annum *Simple Interest, it doth amount to* 270.32 l. *what was the time of forbearance?*

$$a = 218. \quad u = 270.32. \quad g = 0.06.$$

$$\begin{array}{llll} ag & u - a & t & \\ 13.08\,) & \underline{52.32}\,(& 4 \text{ years.} & \text{The Answer.} \\ & 0000 & & \end{array}$$

Prop. 4. Quest. g? Data: a, t, u. Solu: $g = \frac{u - a}{at}$

Example. 218 l. *hath been forborn* 4 *years, and at the end of that time it did amount to* 270.32 l. *at Simple Interest: What was the Gain or Rate of this Simple Interest?*

$$a = 218. \quad t = 4. \quad u = 270.32.$$

$$\begin{array}{llll} at & u - a & g & \\ 872\,) & \underline{52.32}\,(& 0.06\,l. & \text{the Gain of 1 } l. \text{ in one year. The Answ.} \\ & 0000 & & \end{array}$$

SECTION II.

THe business of Simple Interest relating to many equal Payments at many equal times, is a Knack by which Questions are resolved, concerning buying and selling of Annuities and Pensions; and this Knack may be considered under these four Particulars: 1, The Annuity or Pension; 2, The time of continuance; 3, The Gain (or Rate) of 1 *l.* in one year; 4, The Price or present worth (of all those equal Payments at all those equal Times) the Purchasers Money being paid (or supposed to be paid) at one entire Payment, one of those equal Times before his reception of the first Rent or Pension.

This being Premised, the businesses of Simple Interest may be performed from the foregoing *LEMMA.*

If you put $u =$ the Annuity or Pension; $t =$ the time of continuance in years or parts of a year; $g =$ the Gain (or Rate) of 1 *l.* in one year; $p =$ the Price or present worth, the Purchasers Money being paid, as is before specified: Then't will follow, that if any one of these four Particulars u, t, g, p, be sought; it will be discovered by the other three, they being given. As in these four Propositions following.

Prop. 1. Quest. p? Data: u, t, g. Solu: $p = \dfrac{\overline{:gtt + 2t - gt:} \times u}{2gt + 2}$

Example. There is an Annuity of 62 l. per annum, *offered to be sold for* 4 *years, allowing the Purchaser* 6 l. per cent. per annum *Simple Interest: What is this Annuity worth in present Money?*

$u = 62.\quad t = 4.\quad g = 0.06.$

2.48) 540.64 (218 *l.* $= p$. The Answer.
44.
198.
————
0000

Prop.

Prop. 2. Quef. u? Data : p, t, g. Solu : $u = \dfrac{\overline{:2gt + 2:} \times p}{gtt + 2t - gt}$

Example. There is 218 l. *lies ready in Bank, to be laid out at* 6 l. per cent. per annum *Simple Intereſt, to buy an Annuity for* 4 *years: What Annuity may be Purchaſed (upon the conditions aforeſaid) with the* 218 l. *lying in Bank?*

$$p = 218. \quad t = 4. \quad g = 0.06.$$

8.72) 540.64 (62 *l.* = u. The Anſwer.
174 .
――
0000

Prop. 3. Quef. g? Data : u, t, p. Solu : $g = \dfrac{\overline{:ut - p:} \times 2}{2pt + ut - utt}$

Example. An Annuity of 62 l. per annum *for* 4 *years, is offered to be ſold for* 218 l. *What Gain or Rate of Simple Intereſt hath the Purchaſer for his Money* per cent. per annum?

$$u = 62. \quad t = 4. \quad p = 218.$$

1000) 60.00 (0.06 *l.* = g. The Gain of 1 *l.* for 1 year. The Anſ.

Prop. 4. Quef. t? Data : u, g, p.

$$\text{Solu} : t = \frac{\left\{\begin{matrix} +2pg \\ +ug \\ -2u \end{matrix}\right\} + \sqrt{:\left\{\begin{matrix} +2pg \\ +ug \\ -2u \end{matrix}\right\}^{(2)} + 8pug:}}{2ug}$$

Example. A *borrows of* B 218 l. *for which* A *makes over a piece of Land of* 62 l. per annum, *which Rent* B *is now intituled to receive and enjoy, ſo long time 'till he hath full ſatisfaction for his* 218 l. *lent to* A; *and they both agree at* 6 l. per

days.	Decim.
1	.00274
2	.00548
3	.00822
4	.01096
5	.01370
6	.01644
7	.01918
8	.02192
9	.02466
10	.02740
11	.03014
12	.03288
13	.03562
14	.03836
15	.04110
16	.04384
17	.04658
18	.04932
19	.05205
20	.05479
21	.05753
22	.06027
23	.06301
24	.06575
25	.06849
26	.07123
27	.07397
28	.07671
29	.07945
30	.08219
40	.10959
50	.13699
60	.16438
70	.19178
80	.21918
90	.24657
100	.27397
200	.54794
300	.82192
Mo. 1	.08333
2	.16666
3	.25
6	.5
9	.75

per cent. per annum *Simple Interest: How long time must* B *enjoy the Premisses for his* 218 l?

$$n = 62. \quad g = 0.06. \quad p = 218.$$

7.44) 29.76 (4 years = *t*. The Answer.
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Because the time = *t* is always to be valued in years or parts of a year, it will be most commodious to value those parts in Decimals, whether they be Quarters, Months, or Days; for which purpose I have annexed this *Decimal Table*.

This may suffice to be spoken concerning Simple Interest; but I have a word or two to speak concerning the usual way of discounting by Simple Rebate.

Let *Prop.* 1. of this *Section* be Canvast over again, *viz.* 62 l. *per annum* for 4 years, and let us find the present worth of it by their usual way, which is thus.

l.	*y*			*l.*
If 106 due	1	hereafter;	what	58.490
If 112 due	2	be worth in	62 *l*?	55.357
If 118 due	3	present mo-	*facit*	52.543
If 124 due	4	ney 100 *l*		50.000
				216.390

So it seems that he that gives 218 *l.* according to our *Prop.* 1. is cheated of 1 *l.* 12 *s.* 02 *d.* ½. for say they, he ought for his 216 *l.* 07 *s.* 09 *d.* ½.

to

to Receive four Annual Payments of 62 *l.* apiece. But this wee'l try.

A lends to *B* 216.39 *l.* for four years, at 6 *l. per cent. per annum* Simple Intereſt ; which at the end of four years amounts to 268.3236 *l.*

But *A* meeting with ſome croſſes and loſſes (preſently after this Loan) deſires *B* to do him the favour as to let him have 62 *l.* Annually from the day of the Loan : But *B* replies I owe you nothing 'till the four years be expired , and then (God willing) you ſhall have your Principal and Intereſt together ; nevertheleſs I am ſorry for your late loſſes , and if you will allow me the ſame Intereſt that I am to allow you (for that which is Sauce for the Gooſe is Sauce for the Gander) you ſhall not fail to have 62 *l.* Annually paid you ; to which allowance *A* agreed , and did Receive the four Annual payments of 62 *l.* apiece.

Now comes the ſtreſs of the Argument ; whether or no , did the Reception of theſe four Annual payments quit the Accompt between *A* and *B* ? For according to their Simple Tables of Rebate (Tables of Simple Rebate I ſhould ſay) it muſt.

But I think it may be made appear to any Judicious Man , that it doth not quit the Accompt between *A* and *B* , for according to Equity it holds thus.

$$\text{If } 100\,l. \left.\right\} \text{paid before 'tis due} \left\{\begin{array}{c} \overset{y}{3} \\ 2 \\ 1 \\ 0 \end{array}\right\} \text{be worth} \left\{\begin{array}{c} \overset{l.}{118} \\ 112 \\ 106 \\ 100 \end{array}\right\} \text{what } 62\,l.? \text{ facit} \left\{\begin{array}{r} \overset{l.}{73.16} \\ 69.44 \\ 65.72 \\ 62.00 \\ \hline 270.32 \end{array}\right.$$

So you ſee plainly that according to Equity (for *A* and *B* were mutually obliged under one and the ſame Rate and kind of Intereſt) the four Annual payments are worth at the end of four years 270.32 *l.* whereas the whole Amount that *A* could claim of *B* was but 268.3236 *l.* Therefore *A* is got into *B* his Debt 1.9964 *l.* that is 1 *l.* 19 *s.* 11 *d.*

But

But by our *LEMMA*, if *A* had lent to *B* 218*l.* it would (upon the conditions before recited) have Amounted to 270.32*l.* and so they had both been quit; whereby 'tis evident that our *Theorems* (or *Solutions*) agree one with another: Whereas on the contrary, their Rules Clash one against another.

I hope that upon this fair evidence and detection, they will revoke their *Simple* Tables of Rebate, and put *Wiser* in their room or none at all.

A SHORT APPENDIX CONCERNING *The* Solution *of Adfected Equations in Numbers, by Approachment: Laid down in Two Methods.*

METHOD I.

1. LEt the Resolvend (or absolute number) possess the right side of the Equation solely, Signed with the Sign $+$; and the rest of the terms in their Order you shall place on the left side, with their respective Signs; that done, you have an Equation which you may call *The prepared Equation.*

2. On the left side of this *Prepared Equation*, you shall guess at the value of the unknown Symbol or Quesitious Root as near as you can (for the nearer the better) and work out that side (that is gather all those Facts) into one affirmative Result; and if your Result be equal to the proposed Resolvend, you have well guessed,

guessed, for your Supposition is the Questitious Root; and the Equation is solved.

3. If you cannot attain (or get) one Affirmative Result equal to the proposed Resolvend, you must make new Tryals with new Supposititious Roots, 'till you have gotten two Affirmative Results or Resolvends, one greater and the other lesser than the proposed Resolvend; But if two such Resolvends cannot be made, it is an evident sign that the proposed Equation is impossible, or at least hath not an Affirmative Root; and you need not trouble your self any further about it.

4. If two Affirmitive Results or Resolvends can be (or are) made by the prescription of the left side of the *Prepared Equation*, approaching the Resolvend on both sides (the nearer the better) you shall take the difference of the two Supposititious Resolvends, and likewise the difference of their Roots; Then say by the Rule of Proportion:

As } the difference of the two Supposititious { Resolvends.
To } the difference of the two Supposititious { Roots.

So is the difference of the proposed Resolvend and the nearest Supposititious Resolvend; to the difference of their Roots: *Prope verum*

5. Now if you desire more exactness, you may make further Tryals with two nearer Supposititious Roots then you had before; and so proceed by the 4° hereof 'till you have as many Figures in the Questitious Root as will content you.

Example.

Let the Equation proposed be $+400 - y(5) = -12y(2)$
Then the Equation prepared is $y(5) - 12y(2) = +400$

1. I suppose $y = 4$; and by Tryal I have a Resolvend $= 832$
2. I suppose $y = 3$; and by Tryal I have a Resolvend $= 135$
3. I suppose $y = 3.5$; and make Tryal by the aid of Logarithms; and I have a Resolvend $= 378.2$

F $y = 3.5$

$y = 3.5$	its Logarithm 0,5440680
	5
$y(5) = 525.2$	its Logarithm 2,7203400
$y(2) =$ a Number	its Logarithm 1,0881360
12	its Logarithm 1,0791812
$12\,y(2) = 147$	its Logarithm 2,1673172
$y(5) - 12\,y(2) = 378.2$	

4. Because I see that $y > 3.5$ and $y < 4$. I make another Supposition.

$y = 3.6$	its Logarithm 0,5563025
	5
$y(5) = 604.7$	its Logarithm 2,7815125
$y(2) =$ a Number	its Logarithm 1,1126050
12	its Logarithm 1,0791812
$12\,y(2) = 155.5$	its Logarithm 2,1917862
$y(5) - 12\,y(2) = 449.2$	

5. Because I see that $y < 3.6$ and $y > 3.5$ I make another Supposition.

$y = 3.55$	its Logarithm 0,5502283
	5
$y(5) = 563.8$	its Logarithm 2,7511415
$y(2) =$ a Number	its Logarithm 1,1004566
12	its Logarithm 1,0791812
$12\,y(2) = 151.2$	its Logarithm 2,1796378
$y(5) - 12\,y(2) = 412.6$	

Resolv.	*Roots.*
412.6	3.55
400.0	y
378.2	3.5

As 34.4 to 0.05 :: So 12.8 to 0.0316

Which

Which 0.0316 being added to 3.5 makes 3.5316 = y *Prope verum.*

Now if more Figures are desired, you may make a further process by the 4° and 5° hereof.

METHOD II.

1. LEt the Supream Term of the proposed Equation possess the left side of the Equation solely, Signed with the Sign +; and the rest of the terms in their Order you shall place on the right side, with their respective Signs: that done, you shall divide both sides of this Equation by the Superior Potestate of the unknown Symbol now Situate on the right side; then of ~~which~~ same ~~right~~ side (when divided) you shall Extract such a Root as is intimated by the *Index* of the Term standing on the left side; so is the Quesitious Root now solely on the left side: All this being performed, you have an Equation which you may call *The prepared Equation.*

2. On the right side of this *Prepared Equation*, you shall guess at the value of the unknown Symbol or Quesitious Root as near as you can (for the nearer the better) and work out that side into one affirmative Result; and if this Result be equal to your Suppositious Root, you have well guessed, for your Supposition is the Quesitious Root, and the Equation is solved.

3. But if an Affirmative Result cannot be made by the prescription of the right side of the *Prepared Equation*, then the proposed Equation is impossible, or at least hath not an Affirmative Root; and you need not trouble your self any further about it.

4. If the Affirmative Result, made by the prescription of the right side of the *Prepared Equation*, be not equal to your Suppositious Root, you must put that Result for your next Suppositious Root: And proceeding thus, you will approach the Quesitious Root infinitely near.

5. You are to understand, that if the proposed Equation hath but one Affirmative Root, then this *Series* will proceed on

interrupted or Swinging; *viz.* the Results will both increase and decrease. If the proposed Equation have more than one Affirmative Root, then this *Series* will proceed on continued or directly; *viz.* the Results will either increase or decrease. But which of these two proceedings it takes to, will not be discovered till you have three Terms in the *Series*; to wit, your first Supposition and two consequent Results; unless you inform your self by the Doctrine of *determination* of Equations, whether the proposed Equation hath but one Affirmative Root, or more than one.

6. If the *Series* proceed on continued; to hasten it to a Period you may use this help: Triple your last Result, and from thence Subduct away the double of your last Suppositious Root, and that Remainer shall be your next Suppositious Root: And by useing this help you will suddenly either hit upon the Questionous Root or over-shoot it; which will be discovered as soon as ever you find the *Series* to be Stationary, or to run Retrograde: And if it be over-shot, you must not use this help any more, but proceed by the 4° hereof, 'till you come back to a Period.

7. If the *Series* proceed on interrupted; to hasten it to a Period you may use this help: Take the half Sum of your last Result and your last precedent Suppositious Root, and that half Sum shall be your next Suppositious Root: And by useing this help you will suddenly come to a Period.

8. By the way you must note that the property of this *Method* is such, that it still pursues the greatest Root in the proposed Equation, unless it be hindred by some other Root that lyeth in its way: Therefore if you guess large enough at first, this *Method* will bring you down to the greatest Root without any lett or hinderance.

Example.

Let the Equation proposed be $+ y(8) - 6y(3) = + 200$

Then the *Prepared Equation* is $y = \sqrt[5]{: + 6 + \frac{200}{y(3)} :}$

I confess the Limits are of some use to initiate the first guess or Supposition; yet in our *Methods* not of any absolute necessity:

For

For if we can but descry a Root that is too great and another that is too little, it sufficeth. But in the Equation here proposed, we can easily descry that $y < 10$ and $y > 1$ wherefore wee'l put for our first Supposition,

$y = 2$	its Logarithm 0,3010300
	3
$y(3) =$ a Number	its Logarithm 0,9030900
200	its Logarithm 2,3010300
$\frac{200}{y(3)} = 25$	its Logarithm 1,3979400
$y(5) = 31$	its Logarithm 1,4913617
$y = 1.9873$	its Logarithm 0,2982723

$y = 1.9937$	its Logarithm 0,2996598
	3
$y(3) =$ a Number	its Logarithm 0,8989794
200	its Logarithm 2,3010300
$\frac{200}{y(3)} = 25.238$	its Logarithm 1,4020506
$y(5) = 31.238$	its Logarithm 1,4946832
$y = 1.9904$	its Logarithm 0,2989366

$y = 1.9921$	its Logarithm 0,2993111
	3
$y(3) =$ a Number	its Logarithm 0,8979333
200	its Logarithm 2,3010300
$\frac{200}{y(3)} = 25.299$	its Logarithm 1,4030967
$y(5) = 31.299$	its Logarithm 1,4955304
$y = 1.9911$	its Logarithm 0,2991061

$y = 1.9916$	its Logarithm 0,2992021
	3
$y(3) =$ a Number	its Logarithm 0,8976063
200	its Logarithm 2,3010300
$\frac{200}{y(3)} = 25.318$	its Logarithm 1,4034237
$y(5) = 31.318$	its Logarithm 1,4957940
$y = 1.9914$	its Logarithm 0,2991588
$y = 1.9915$	its Logarithm 0,2991803
	3
$y(3) =$ a Number	its Logarithm 0,8975409
200	its Logarithm 2,3010300
$\frac{200}{y(3)} = 25.322$	its Logarithm 1,4034891
$y(5) = 31.322$	its Logarithm 1,4958495
$y = 1.9915$	its Logarithm 0,2991699

So because my last Result, is equal to my last precedent Supposition, the Series is Stationary, and the Quesitious Root $= 1.9915$.

FINIS.

Arts and Sciences *MATHEMATICAL*.

Arithmetick, *in Whole Numbers and Fractions: With the Art of* Decimals, *supplying the use of Vulgar Fractions.*

Logarithms, *with their Construction; and Use in Compound Interest and Annuities.*

Geometry, *the Principles; and Practice in Measuring of Superficies and Solids, as Board and Timber, Glass and Stone*, &c.

Algebra, *or Symbolical Arithmetick, in the several Species of it, as Addition, Subtraction, Multiplication, and Division: Together with the* Genesis *and* Analysis *of Powers, from a Solinomial, Binomial*, &c.

The

The Doctrine of Equations, *according to these ten Heads or Chap.*

Chap. I. Of the Nature *and* Constitution *of Equations.*

Chap. II. Of the Limits *of Equations, whereby the possibility or impossibility of an Equation is discovered.*

Chap. III. Of the Determination *of Equations, whereby is discovered, whether an Equation hath in it a pair of equal Roots, or not. And many other properties of the Roots.*

Chap. IV. Of the Comparison *of two or more Equations having one common Root, whereby to get that common Root (if it be rational) without Extraction.*

Chap. V. Of the Reduction *of Equations, consisting of these ten Rules following; whose use and benefit will be very profitable when need shall require.*

Rule 1. *An Equation being proposed, To change its negative Roots into affirmative Roots,* & contra.

Rule 2. *An Equation being proposed, having in it one known Root; To reduce it to an Equation one grade lower. By a peculiar Method of the Authors.*

Rule 3. *An Equation being proposed, having in it a pair of Roots, whose sum, difference, fact, or* ratio *is known; To reduce it to an Equation of fewer Dimensions.*

Rule 4. *An Equation being proposed, having in it a pair of equal Roots; To reduce it to an Equation, wherein one of that pair (if it be rational) may be got without Extraction.*

Rule 5. *An Equation being proposed, To reduce it to a new Equation of the same degree, wherein the mean terms are turned end for end. Hereby you may change a higher Potestate for a lower,* & contra.

Rule 6. *An Equation being proposed, To reduce it to a new Equation of the same degree, whose Roots shall be so much greater, or so much lesser, than the Roots of the Equation proposed. Hereby the second term of an Equation may be taken away with some labour, or any other of the inferiour terms with more labour.*

Rule 7. *An Equation being proposed, To reduce it to a new Equation of the same degree, whose Roots shall have (or bear) any* ratio *assigned, to the Roots of the Equation proposed.*

Rule 8. *An Equation being proposed, To reduce it to a new Equation of the same degree, and having any quantity assigned, imposed*

upon

upon any one of the Coefficients of its inferiour terms. Hereby you may take away Fractions or Surd Roots, when they shall be proposed.

Rule 9. An Equation being proposed, To reduce it to a new Equation of the same deg. and having any ratio assigned, imposed upon any two of the Coefficients of its inferiour terms. Hereby you may take away any one term, except the highest and the lowest, with more ease than by the sixth hereof, if you please to raise the Equation one deg. higher.

Rule 10. An Equation being proposed, having its second term extant; To reduce it to a new Equation of the same degree, wherein the second term shall be abolished: In which Reduction, the Habitudes of the new Coefficients to the old are made conspicuous; whereby you may descry when such a term or terms will be abolished with the second.

Chap. VI. Of the general method for the Solution of any Equation, whether pure or adfected.

Chap. VII. Of the Solution of Quadratique Equations adfected, by way of Compendium.

Chap. VIII. Of Solving Equations by approachment: Performed by Logarithms.

Chap. IX. Of Breaking a Biquadratique Equation, into two Quadratique Equations, its begetters: 1. When there is something or other known in the begetters; 2. When there is nothing at all known in the begetters; 3. When the Resolvend is at liberty to be what it shall fall out to be, then to break always rationally.

Chap. X. Of the Sum of the Squares, the Sum of the Cubes, the Sum of the Biquadratiques, &c. of the Roots of any Equation proposed.

The Construction of the Inscripts and Adscripts of a Circle, that is, Chords, Sines, Versed Sines, Tangents, and Secants. In order to,

Trigonometry, both Plane and Spherical; not only the ordinary cases, but extraordinary and doubtful cases; and applied to Navigation, or Sailing by the Plane-chart, Mercator's-chart, and the Arch of a great Circle.

Gauging of Vessels, as Tuns, Coppers, Coolers, and Cask, either the whole or the parts; by undeniable Rules of Art, if they be regular. If irregular, by the usual way of taking a competent number of mean Diameters.

Dialling, (that is the Gnomonical Projection of the Sphere) upon any Plane, however declining, inclining, or reclining: 1. In a Triangle, by Mr. Foster's Line of Latitudes and Line of Hours. 2. In a Circle, by the Line of ☉. 3. In a Parallelogram, by Tangents. 4. By Calculation.

These Arts and Sciences are Taught by the Author *Michael Dary*, *Philomath*, in *King Harry*'s Yard, near the *Hermitage*, *Wapping*.